

Engineering Technology

Program of Studies

2017-2018



Learning that works for Kentucky

CTETM

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Kentucky Department of Education



Engineering Technology Courses

Course Title	Post-Secondary Connection	Course Code	Recommended Grade Level				Recommended Credit
			9	10	11	12	
Advanced Design Applications	MSU IET 120	210117			x	x	1
Advanced Technology for Design and Production (SREB)		210136	x	x			1
Alternative Energy		210243		x	x	x	1
Architectural Design and Civil Engineering		210140		x	x	x	1
Energy I: Energy Industry Basics	KCTCS ENM 1011	210245	x	x	x	x	1
Energy II: Power Generation and Distribution	KCTCS ENM 1012	210246		x	x	x	1
Energy III: Emerging Technologies in Energy	KCTCS ENM 1013	210247			x	x	1
Energy IV: Sustainability Management	KCTCS ENM 111	210248				x	2
Engineering and Engineering Technology Co-op		210330			x	x	1
Engineering and Engineering Technology Design (Capstone)		210110			x	x	1
Engineering and Engineering Technology Internship		210331			x	x	1
Foundations of Energy		210341	x	x	x		1
Foundations of Engineering Technology		210107	x	x	x	x	1
Foundations of Robotics		210238	x	x			1
Fundamentals of Architectural and Civil Engineering		210223	x	x	x	x	1
Fundamentals of Building Construction Technologies		210141			x	x	1
Global Energy Issues		210244		x	x	x	1
Graphic Communications		210133	x	x	x	x	1
Introduction to Alternative Energy		210242		x	x		1
Introduction to Manufacturing and Manufacturing Systems		210225	x	x	x	x	1
Mechanical and Technical Design	MSU ITCD 103 MRY ITD 105 KCTCS CAD 100	210138	x	x			1
Mechatronic Systems for Advanced Production (SREB)		210143			x	x	1
Power and Energy Equipment Technology		210142	x	x	x	x	1

Production Technology		210135			x	x	1
Principles of Engineering Technology		210224	x	x			1
Robotics Application Capstone		210240			x	x	1
Robotics Design Essentials and Systems		210239	x	x	x	x	1
Systems of Advanced Technology (SREB)		210137		x	x		1
Technological Design		210108	x	x	x	x	1

Note: All post-secondary connections are individual agreements that will need to be created between the post-secondary institution and the local school district. Local school districts are also encouraged to reach out to other post-secondary institutions to expand these connections.

MSU = Morehead State University

MRY = Murray State University

KCTCS = Kentucky Community and Technical College System

K-12 Science, Technology, Engineering and Math (STEM) Pathway

Elementary School STEM Program

School districts are encouraged to explore the concept of a K-12 STEM pipeline. This career pathway would facilitate exploration, the attainment of knowledge and skills necessary for informed participation and gainful employment in a technologically dependent society. This pipeline may include a recommended sequence of courses that would allow integration and interdisciplinary instruction of important concepts. Beginning this pipeline at the elementary level could help the students focus their learning.

Middle School STEM Program

Programs in the middle school provide an exploration into STEM and how it connects skills from other academic disciplines. Students experience the design process as they invent devices to solve various problems. Students learn of system requirements, processes and controls as they wrestle with trade-offs due to design constraints. Students apply scientific and mathematical knowledge as they analyze data to predict performance. Students learn the proper and safe operation of some basic tools as their ideas begin to take shape. Through these experiences, students begin to understand the forces that drive our technological society and how these forces can be controlled and directed. Instructional approaches include problem solving/design briefs where students build projects, small/large group instruction, discussion, research, student presentations, and other successful pedagogy. **STEM at the middle school level should include a local chapter of the Technology Student Association (TSA) and can incorporate many of the TSA activities within the curriculum.**

A middle school STEM course is generally offered for six to eighteen weeks for a single class period each day. Alternative schedules that provide for equivalent contact hours may also be implemented. A total program of STEM consists of a minimum of three course offerings, one for each grade level (6-8).

High School Engineering Program

The U.S. has approximately 1.6 million engineering jobs that pay \$42 per hour in median wages. Civil engineers account for the most jobs of any engineering field (274,000 in 2014), followed closely by mechanical engineers (264,000) and industrial engineers (229,000). Those three engineering jobs, plus electrical engineers and electronics engineers, make up two-thirds of the American engineering workforce.

<http://www.forbes.com/sites/emsi/2014/09/12/the-most-in-demand-and-oldest-engineering-jobs/#6f57082c4b4a>

The Commonwealth of Kentucky has created high school engineering pathways to excite and drive interest in these top Engineering fields. Special attention is also paid to Aerospace Engineering as this is Kentucky's top export and only second to Washington State in export dollars.

High School Engineering Technology Program

This program of studies includes the practical application of science and engineering and exposes students to a wide range of real world problems. The Commonwealth of Kentucky offers a wide array of Engineering Technology and Science, Technology, Engineering and Math (STEM) related High School Career Pathways to create a future workforce ready for industry needs.

Career and Technical Education/Engineering Hybrid Pathways

Project Lead The Way (PLTW) and the Office of Career and Technical Education (CTE) worked together to create further opportunities for students that are enrolled in secondary CTE specific programs. These are referred to as Hybrid pathways that consist of courses within the specific program area with the addition of selected Engineering courses relative to that career area. Since their inception, the hybrid pathways now include nonPLTW engineering courses to allow expanded access across the Commonwealth. These pathways blend CTE courses with Engineering courses to help students apply technical skills along with Science, Technology, Engineering, and Math (STEM) skills to solve real-world problems and to meet the demands of industry for individuals with both technical and engineering knowledge and skills.

Student Organizations

Participation in Technology Student Association (TSA) provides a vehicle for students to employ higher order thinking skills, to interact with industry individuals to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities.

Imagine an activity so captivating that your students spend hours working on it after school for weeks at a time. That's what happens when TSA members engage in TSA's competitions. Only TSA members have the opportunity to compete at exciting regional, state and national conferences. Expert judging by technology educators and industry representatives inspires the best from participants. Members are rewarded not only with medals or trophies, but also with memories of the camaraderie and the challenge brought on by TSA.

STEM at the middle school level as well as Engineering and Engineering Technology at the high school level should include a local chapter of Technology Student Association (TSA) and can incorporate many of the TSA activities within the curriculum.

Engineering Vs. Engineering Technology

According to the Accreditation Board for Engineering and Technology Inc. (ABET); engineering and engineering technology are separate but closely related professional areas that differ in:

- **Curricular Focus** – Engineering programs often focus on theory and conceptual design, while engineering technology programs usually focus on application and implementation. Engineering programs typically require additional, higher-level mathematics, including multiple semesters of calculus and calculus-based theoretical science courses, while engineering technology programs typically focus on algebra, trigonometry, applied calculus, and other courses that are more practical than theoretical in nature.
- **Career Paths** – Graduates from engineering programs are called engineers and often pursue entry-level work involving conceptual design or research and development. Many continue on to graduate-level work in engineering. Graduates of four-year engineering technology programs are called technologists, while graduates of two-year engineering technology programs are called technicians. These professionals are most likely to enter positions in sectors such as construction, manufacturing, product design, testing, or technical services and sales.

<http://www.abet.org/accreditation/new-to-accreditation/engineering-vs-engineering-technology/>

Engineering and Engineering Technology – What is the difference?

This question is asked repeatedly by graduating high school seniors who are considering the field of engineering as a career. They are told that engineering is science-oriented, stressing mathematics, natural and engineering science, engineering design, and the development of engineering research competencies. On the other hand, engineering technology is practice-oriented, stressing applications of engineering science, engineering design, and laboratory experience competencies. The potential student in engineering education is still confused because of the apparent overlap in the definitions. The student must understand that the field of engineering comprises a broad spectrum of occupations requiring different abilities, interest and skills. Both engineering and engineering technology are viable professional paths that lead to rewarding and successful careers. It is important for students to carefully assess their abilities, interests and personal career objectives before deciding between engineering and engineering technology. The student should study the following comparisons in order to decide which career path best fits his or her abilities and interests. All too often, graduating high school seniors enroll in engineering curriculums without realizing there is another alternative in which they could be more successful, during both academic preparation and the career that follows.

According to Payscale.com which gathers salary and employment data for the federal government, the average starting salaries for both Engineering graduates as well as Engineering Technology graduates are almost identical, hovering around \$47k* annually as of December 2016. *updated to reflect current pay

Post-Secondary Comparison of Engineering and Engineering Technology

This comparison list is modeled from a brochure, “Mechanical Engineering and Mechanical Engineering Technology, Which Path Will You Take”, published by the American Society of Mechanical Engineers.

ENGINEERING

ENGINEERING TECHNOLOGY

Program Guide Characteristics	
An innovator—one who is able to interweave a knowledge of advanced mathematics, the natural and engineering sciences, and engineering principles and practices with considerations of economic, social, environmental, and ethical issues to create new systems and products.	A doer or implementer—one who is able to apply a basic knowledge of mathematics, the natural and engineering sciences, current engineering practices, and an understanding of economic principles of the solution of design problems and to the operation or testing of engineering and manufacturing systems.

Program Objectives	
To provide the knowledge necessary to design and manufacture state-of-the-art products and systems needed to meet the current and future needs of society. To provide the knowledge required to apply state-of-the-art techniques and designs to meet the current needs of society.	To provide the knowledge required to apply state-of-the-art techniques and designs to meet the current needs of society.

Program Emphasis	
Emphasis is on developing methods of analysis and solutions for open-ended design problems.	Emphasis is on applying current knowledge and practices to the solution of specific technical problems.

Expertise Objectives	
To develop conceptual abilities.	To develop application abilities.

Program Length	
Four years.	Four years. Transfer students from community colleges may take longer if they do not have basic math and science courses in freshman and sophomore years.

ENGINEERING

ENGINEERING TECHNOLOGY

Courses in Major Field	
Engineering students usually do not begin major field of study until the latter part of sophomore year or junior year.	Engineering technology students begin major field of study in the freshman year.

Degrees Awarded	
B.S. in Engineering	B.S. in Engineering Technology

Academic Terminology	
Graduates are referred to as engineers.	Graduates are referred to as engineering technologists. Job titles after entering industry will be “engineers” more often than not.

Program Basis	
The equivalent of one full year of mathematics and basic science courses provides the foundation for the program that is calculus based.	The equivalent of three-quarters of a year of mathematics and basic science. Engineering Technology programs are algebra-based, but calculus usage is required as a subject.

Emphasis of Technical Courses	
Engineering courses stress the underlying theory of the subject matter.	Technology courses stress the application of technical knowledge and methods in the solution of current industrial type problems.

Emphasis of Laboratory Courses	
Laboratory courses provide an intensive overview of experimental methods and of the related underlying theories.	Laboratory courses, an integral component, stress practical design solutions as well as manufacturing and evaluation techniques appropriate for industrial type problems.

Technical Design Emphasis	
General design principles, applicable to a wide variety of problem situations, are developed.	Current design procedures of a complex, but well-established nature are developed and applied to problems in a specialized technical area.

Transfer Potential	
Transfer to a technology program from an engineering curriculum is possible with a minimum loss of credits and time.	It is generally not possible to transfer to an engineering curriculum from a technology program without a significant loss of credits and time.

ENGINEERING

ENGINEERING TECHNOLOGY

Typical Aspirations of the New Graduate	
The engineering graduate entering industry would most likely aspire to an entry-level position in conceptual design, systems engineering, manufacturing, or product research and development.	A graduate entering industry would most likely aspire to an entry-level position in product design, development, testing, technical operations, or technical services and sales.
Technical Interest	
The engineering graduate is relatively broad and has an analytical, creative mind challenged by open-ended technical problems.	A graduate is relatively specialized and has an applications orientation, challenged by specific technical problems.
Adaptability to Current Industrial Practices	
An engineering graduate typically requires a period of “internship” since engineering programs stress fundamentals.	A graduate is prepared to immediately begin technical assignments since technology programs stress current industrial practices and design procedures.
Mobility	
Many engineers move into management positions.	The majority of engineering technologists move into industrial supervisory positions. Many move into management positions.
Professional Registration	
Graduates of engineering schools are eligible to become registered professional engineers in all states by a process of examination and documentation of experiences.	Graduates of engineering technology schools may become professionally certified in their specific areas of expertise. Technologists may become registered professional engineers in many states; however, the requirements are usually different than those for engineers.
National Accreditation	
Accredited by the Accreditation Board for Engineering and Technology—Engineering Accreditation Commission (EAC of ABET.)	Accredited by the Accreditation Board for Engineering and Technology—Technology Accreditation Commission (TAC of ABET.)
Graduate Education Opportunities	
Graduate study in engineering as well as other areas is available for qualified students having a B.S. in engineering.	Graduate study in technology is limited to a few universities and entrance to graduate engineering programs is most often difficult. Advanced degrees in technical education and business are possible.

<https://www.suu.edu/cose/et/pdf/eng-vs-et.pdf>

Kentucky High School Pathways

Engineering Pathways

- Aerospace Engineering (14.0201.01)
- Civil Engineering (14.0801.00)
- Electrical/Electronics Engineering (14.1001.00)
- Industrial/Mechanical Engineering (14.3501.00)

Career and Technical Education (CTE) and Engineering Hybrid Pathways

- Automotive Engineering (15.0803.00)
- Computerized Manufacturing and Machining (CMM) Engineering (48.0510.00)
- Construction Architectural Engineering (15.0101.02)
- Design Engineering (15.1304.00)
- Electrical Construction Engineering (15.0303.00)
- Fabrication Engineering (14.1901.00)
- Fluid Power Engineering (15.1103.00)
- Industrial Maintenance/Electrical Engineering (14.4101.00)
- Structural Engineering (14.0803.00)
- Welding Engineering (15.0614.00)
- Wood Manufacturing Engineering (03.0509.00)

Engineering Technology Pathways

- [Civil Architecture and Construction Technology \(15.0101.01\)](#)
- [Energy Management \(15.0503.02\)](#)
- [Engineering Technology Design \(15.1302.00\)](#)
- [Graphic and Digital Communications \(10.0105.00\)](#)
- [Manufacturing Engineering Technology \(15.0613.00\)](#)
- [Robotics and Automation \(15.0405.00\)](#)
- [Sustainability and Energy Application Technician \(15.0503.01\)](#)

Flight and Aviation Pathways

- Flight and Aeronautics (49.0102.00)
- Aircraft Maintenance Technician (47.0607.00)

Kentucky Occupational Skill Standards

The Kentucky Occupational Skill Standards are the performance specifications that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. Identifying the necessary skills is critical to preparing students for entry into employment or postsecondary education. Because of the importance of skill standards, the Office of Career and Technical Education in conjunction with the Kentucky Association of Manufacturers, Toyota, Southern Regional Education Board, Alltech, Cumberland Valley Resources, Alliance Coal, Kentucky Oil & Gas Association, Department of Energy Development & Independence, Tennessee Valley Authority, Appalachian Electric Power, Ashland Oil, Home Builders Association of Kentucky, National Energy Education Development, LGE-KU, and various post-secondary institutions/advisors worked to develop a system to certify that students have attained the necessary skills for employment or postsecondary education. Standards were developed in the areas of Manufacturing, Aerospace and Aeronautics, Engineering and Technical Design, Power-Energy and Transportation. These standards described the necessary **occupational, academic, and employability** skills needed to enter the workforce or post-secondary education in specific career areas. There is an ongoing effort to continue to refine these standards by which exemplary Engineering and Technology Education Programs are evaluated and certified. The strength of these partnerships insures that curriculum meets industry specifications.

Valid KOSSA and Industry Certification for Career Readiness

The Valid List of KOSSA and Industry Certifications for Career Readiness can be viewed via the following link: <http://education.ky.gov/CTE/kossa/Pages/ValidKOSSAList.aspx>. The valid list is reviewed annually through the established process and publishes by June 1 for the corresponding academic year.

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

CIVIL ARCHITECTURE AND CONSTRUCTION TECHNOLOGY

CIP 15.0101.01

PATHWAY DESCRIPTION: This pathway prepares students to apply engineering principles and technical skills in support of architects, engineers and planners engaged in designing and developing buildings, urban complexes, and related systems. Includes instruction in design testing procedures, building site analysis, model building and computer graphics, structural systems testing, analysis of prototype mechanical and interior systems, report preparation, basic construction and structural design, architectural rendering, computer-aided drafting (CAD), layout and designs, architectural blueprint interpretation, building materials, and basic structural wiring diagramming.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

Choose (1-2) ONE-TWO CREDIT(S) from the following:

- [210107](#) Foundations of Engineering Technology
- [210224](#) Principles of Engineering Technology

Complete (1) ONE CREDIT:

- [210223](#) Fundamentals of Architectural and Civil Engineering

Choose (1-2) ONE-TWO CREDIT(S) from the following:

- [210140](#) Architectural Design and Civil Engineering
- [210141](#) Fundamentals of Building Construction Technologies
- [210110](#) Engineering and Engineering Technology Design (Capstone)
- [210330](#) Engineering and Engineering Technology Co-op **OR** [210331](#) Engineering and Engineering Technology Internship

Engineering Technology Instructor

Architect

Interior Designer

Home Improvement Contractor

Carpenter

Construction Laborer

Construction Manager

Construction Supervisor

Project Manager

Building Inspector

Drafter

Renovator

Quality Controller

Building Superintendent

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

ENERGY MANAGEMENT

CIP 15.0503.02

PATHWAY DESCRIPTION: Madisonville Community College's Energy Management program, with its national certifications embedded within the curriculum, prepares students for a variety of employment opportunities. Entry level positions in the energy production industry include renewable energy sales, LEED consultant, alternative energy consultants, residential audits, etc. Energy Management graduates can also find employment in the growing fields of energy audit, energy consulting, and facilities management. Employment opportunities are expected to be the greatest in metropolitan areas.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

*Complete (4) **FOUR CREDITS:***

- [210245](#) - Energy I: Energy Industry Basics
- [210246](#) - Energy II: Power Generation and Distribution
- [210247](#) - Energy III: Emerging Technologies in Energy
- [210248](#) - Energy IV: Sustainability Management

Note: This Pathway requires partnership with a post-secondary institution to enable student achievement of the industry certification which can equate to post-secondary credit.

Engineering Technology Instructor

Outdoor Power Equipment Technician

Small Engine Mechanic

Solar Energy Technician

Wind Power Technician

Energy Auditor

Wind Power Technician

Energy Auditor

Electrical Mechanical Technician

Power Plant Technician

Turbine Technician

Energy Analyst

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

ENGINEERING TECHNOLOGY DESIGN

CIP 15.1302.00

PATHWAY DESCRIPTION: Designed for students interested in the various disciplines of engineering technology. The sequence of courses will provide students with the opportunity to develop critical thinking skills and understanding of engineering concepts. Students then apply these skills in conjunction with the multi-step engineering design process to solve real-world problems. Includes instruction in two-dimensional and/or three-dimensional engineering design software, solid modeling, and engineering animation to solve real-world problems.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

Choose (1-2) ONE-TWO CREDIT(S) from the following:

- [210107](#) Foundations of Engineering Technology
- [210224](#) Principles of Engineering Technology

Complete (1) ONE CREDIT:

- [210138](#) Mechanical and Technical Design

Choose (1-2) ONE-TWO CREDIT(S) from the following:

- [210108](#) Technological Design
- [210117](#) Advanced Design Applications
- [210110](#) Engineering and Engineering Technology Design (Capstone)
- [210330](#) Engineering and Engineering Technology Co-op **OR** [210331](#) Engineering and Engineering Technology Internship

Engineering Technology Instructor

CAD Technician/Drafter

Mold Designer

Mechanical Designer

Industrial Material

Handling Designer

ENGINEERING TECHNOLOGY CAREER PATHWAYS 2017-2018

GRAPHIC AND DIGITAL COMMUNICATIONS CIP 10.0105.00

PATHWAY DESCRIPTION: Students acquire fundamental skills in image creation and management procedures and techniques as they create, revise, optimize, and export graphics for video, print and web publishing. Students learn digital photography and understand copyright basics to apply to a digital portfolio.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

Complete (1-2) ONE-TWO CREDIT(S) from the following:

- [210107](#) Foundations of Engineering Technology
- [210224](#) Principles of Engineering Technology

Complete (1) ONE CREDIT:

- [210133](#) Graphic Communications

Choose (1-2) ONE-TWO CREDIT(S) from the following:

- [210108](#) Technological Design
- [210110](#) Engineering and Engineering Technology Design (Capstone)
- [210330](#) Engineering and Engineering Technology Co-op **OR** [210331](#) Engineering and Engineering Technology Internship

Engineering Technology Instructor

Communications Technician

Graphic Designer

Desktop Publisher

Web Designer

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

MANUFACTURING ENGINEERING TECHNOLOGY

CIP 15.0613.00

PATHWAY DESCRIPTION: This pathway prepares students to apply engineering principles, mathematical and scientific principles to the design, development and operational evaluation of integrated systems for managing industrial production processes, just-in-time manufacturing, industrial quality control, automation, cost analysis, and technical skills to the identification and resolution of production problems in the manufacture of products. Includes instruction in machine operations, production line operations, engineering analysis, systems analysis, instrumentation, physical controls, automation, computer-aided manufacturing (CAM), manufacturing planning, quality control, and informational infrastructure.

BEST PRACTICE COURSES	EXAMPLE ILP-RELATED CAREER TITLES
<p><i>Complete (2) TWO CREDITS:</i></p> <ul style="list-style-type: none"> • 210136 Advanced Technology for Design and Production (SREB) OR • 210107 Foundations of Engineering Technology • 210224 Principles of Engineering Technology OR • 210137 Systems of Advanced Technology (SREB) <p><i>Choose (2) TWO CREDITS from the following:</i></p> <ul style="list-style-type: none"> • 210225 Introduction to Manufacturing and Manufacturing Systems • 210238 Foundations of Robotics • 210117 Advanced Design Applications • 210143 Mechatronic Systems for Advanced Production (SREB) • 210135 Production Technology • 210110 Engineering and Engineering Technology Design (Capstone) • 210330 Engineering and Engineering Technology Co-op OR • 210331 Engineering and Engineering Technology Internship 	<p>Engineering Technology Instructor</p> <p>Production Woodworker</p> <p>Manufacturing Manager</p> <p>Manufacturing Worker</p> <p>Industrial Engineer</p> <p>Electronics Assembler</p> <p>Industrial Technician</p> <p>Quality Controller</p> <p>Note: (SREB) courses require an agreement between the Southern Region Education Board and the local school district.</p>

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

ROBOTICS AND AUTOMATION

CIP 15.0405.00

PATHWAY DESCRIPTION: This pathway prepares students to apply engineering principles and technical skills in support of engineers and other professionals engaged in developing and using robots. Includes instruction in the principles of robotics, design and operational testing, system maintenance and repair procedures, robot computer systems and control language, specific system types and applications to specific industrial tasks, and report preparation.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

*Choose (1-2) **ONE-TWO CREDIT(S)** from the following:*

- [210107](#) Foundations of Engineering Technology
- [210224](#) Principles of Engineering Technology

*Complete (1) **ONE CREDIT**:*

- [210238](#) Foundations of Robotics

*Choose (1-2) **ONE-TWO CREDIT(S)** from the following:*

- [210239](#) Robotics Design Essentials and Systems
- [210240](#) Robotics Application Capstone
- [210330](#) Engineering and Engineering Technology Co-op **OR**
[210331](#) Engineering and Engineering Technology Internship

Engineering Technology
Instructor

Solar Energy Technician

Wind Power Technician

Energy Auditor

Electrical Mechanical
Technician

Power Plant Technician

Turbine Technician

Energy Analyst

ENGINEERING TECHNOLOGY CAREER PATHWAYS

2017-2018

SUSTAINABILITY AND ENERGY APPLICATION TECHNICIAN

CIP 15.0503.01

PATHWAY DESCRIPTION: This pathway prepares students to apply engineering principles and technical skills in support of engineers and other professionals engaged in developing energy-efficient systems or monitoring energy use. The content includes activities to develop knowledge and skill in, but is not limited to the study of power systems and the kinds and sources of energy, repair, service, and maintenance of small internal-combustion engines used on portable power equipment such as generators, electrical motors, generators, and wind turbines. The content and activities will also include the study of safety, and leadership skills.

BEST PRACTICE COURSES

EXAMPLE ILP-RELATED CAREER TITLES

Complete (2) TWO CREDITS:

- [210341](#) Foundations of Energy
- [210242](#) Introduction to Alternative Energy

Choose (2) TWO CREDITS from the following:

- [210243](#) Alternative Energy
- [210244](#) Global Energy Issues
- [210142](#) Power and Energy Equipment Technology
- [210330](#) Engineering and Engineering Technology Co-op **OR**
[210331](#) Engineering and Engineering Technology Internship

Engineering Technology Instructor

Outdoor Power Equipment Technician

Small Engine Mechanic

Solar Energy Technician

Wind Power Technician

Energy Auditor

Wind Power Technician

Energy Auditor

Electrical Mechanical Technician

Power Plant Technician

Turbine Technician

Energy Analyst

COMPLEMENTARY OR ADVANCED COURSEWORK BEYOND ENGINEERING TECHNOLOGY PATHWAY(s)
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Upon completion of a pathway, additional coursework to enhance student learning is encouraged.
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Credits earned in Advanced or Complementary Coursework “Beyond the Pathway” may not be substituted for pathway courses in order to achieve Preparatory or Completer status.

210112 Special Topics, Engineering Technology

Energy Management

Access to this curriculum requires a partnership with a Post-Secondary Institution to enable successful attainment of the industry certification. Updated course content and information can be obtained via:

http://www.madisonville.kctcs.edu/en/Academics/Programs_of_Study/Energy_Management.aspx

Energy I: Energy Industry Basics Valid Course Code: 210245
Course Description: Investigates competencies required for employment by various industries that manufacture energy sources. Addresses the competencies identified by the Center for Energy Workforce Development (CEWD) organization that are needed for energy industries. Combined with Energy II and Energy III qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.
Energy II: Power Generation and Distribution Valid Course Code: 210246
Course Description: Introduces students to methods of power production, power distribution, and physics principles that are associated with both. Addresses the competencies identified by the Center for Energy Workforce Development (CEWD) organization that are needed for energy industries. Combined with Energy I and Energy III qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.
Energy III: Emerging Technologies in Energy Valid Course Code: 210247
Course Description: Introduces students to emerging technologies and careers in the energy industry. It is the third of three modules that addresses the competencies identified by the Center for Energy Workforce Development (CEWD) organization that are needed for energy industries. Combined with Energy I and Energy II qualifies students to take the CEWD Energy Industry Fundamentals (EIF) certification exam. Participation in Kentucky Technology Student Association will greatly enhance instruction.
Energy IV: Sustainability Management Valid Course Code: 210248
Course Description: Examines the management of corporations as it relates to sustainability. Includes an overview of energy technology, energy resources, and emerging future energy technologies coupled with social and environmentally related legislation and its effect on corporations' triple bottom line (people, profit, and planet). Participation in Kentucky Technology Student Association will greatly enhance instruction.
Connections
<ul style="list-style-type: none"> • Kentucky Technology Student Association (KYTSA) • Kentucky Occupational Skill Standards (KOSSA) <u>OR</u> Appropriate Industry Certification • Standards for Technological Literacy • Kentucky Academic Standards • Center for Energy Workforce Development (CEWD)

Southern Regional Education Board (SREB) Integrated Production Technologies Courses

Access to curriculum for SREB Integrated Production Technologies program requires an agreement with SREB. Updated course content and information can be obtained from SREB via: <http://www.sreb.org/publication/integrated-production-technologies>.

Advanced Technology for Design and Production (SREB) Valid Course Code: 210136
<p>Course Description: This course engages students in the use of modern technologies in the design and improvement of products. Students use three-dimensional CAD software in the creation and analysis process. Students document designs using standards set by industry for design documentation. Students implement methods of green production and just-in-time component supply, which allow for the lowest cost and highest quality products. Students design and troubleshoot data acquisition, programmable logic control, process monitoring, automation, and robotic systems. Students incorporate sensing and vision systems, utilizing cameras and sensors to control automated systems. Participation in Kentucky Technology Student Association will greatly enhance instruction.</p>
Mechatronic Systems for Advanced Production (SREB) Valid Course Code: 210143
<p>Course Description: Students will design cost-effective work cells incorporating automation and robotics to improve quality of final products. The advanced production in this course depends on the use and coordination of information, automation, network systems, vision and sensing systems. Students will design and create mechatronic systems and automated tooling to accomplish these advanced tasks. Students produce authentic documentation about their cyber-mechanical systems and the integration with data to control and monitor processes. Participation in Kentucky Technology Student Association will greatly enhance instruction.</p>
Systems of Advanced Technology (SREB) Valid Course Code: 210137
<p>Course Description: In this course, students apply the technologies that are found in modern clean, production environments. Students study effective and energy efficient control of pumping, conveyors, piping, pneumatic and hydraulic control systems. Students apply total quality management to production design to assure quality. Students also focus on properties of materials and material testing, creating documentation to support designs, examining properties, and justifying material selections based on properties. Students learn that old products become the new raw materials for new products. Participation in Kentucky Technology Student Association will greatly enhance instruction.</p>
<ul style="list-style-type: none"> • Kentucky Technology Student Association (KYTSA) • Kentucky Occupational Skill Standards (KOSSA) <u>OR</u> Appropriate Industry Certification • Standards for Technological Literacy • Kentucky Academic Standards

Advanced Design Applications

Valid Course Code: 210117

Course Description: This course is a continuation into the broad perspective of the science, engineering and technology. It focuses on understanding concepts and skills of engineering and technology. Students will learn the importance of the application of critical thinking and problem solving skills in pursuing an engineering and technology related careers. Students will gain a deeper understanding of these technological areas: Energy and Power, Information and Communication, Transportation, Manufacturing, Construction, Medical, Agriculture, and Bio-Related Technologies. Students engage in individual and group activities creating ideas; developing innovations; and designing, fabricating, and engineering practical solutions to a variety of technological problems. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Continue to explore technological concepts and processes in the contexts of Energy and Power, Information and Communication, Transportation, Manufacturing, Construction, Medical, Agriculture and Bio-Related Technologies.
3. Demonstrate an understanding of technological systems and the interrelationship between the resource/input, process, output, and feedback elements of these systems.
4. Develop competencies in the safe, efficient, and effective use of tools, machines, materials, and processes.
5. Determine the best design solutions, utilizing CAD software, to a variety of real-world design problems.
6. Utilize rapid prototyping to refine and test designs.
7. Construct models and/or prototypes using various fabrication techniques.
8. Present final design solutions to community stake-holders.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR** Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Alternative Energy

Valid Course Code: 210243

Course Description: This course provides students with the foundation in content and skills associated with various energy sources, and electrical power generation, transmission, and distribution. Students will develop competencies in the area of energy history and the global impact of renewable and non-renewable resources; career opportunities; environmental principles, working with AC/DC electrical circuits, and transfer of various energy forms to produce DC current. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Prerequisite: 210242 Introduction to Alternative Energy

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Prepare labs to demonstrate the understanding of AC/DC electrical circuits.
3. Demonstrate knowledge viability of biomass and biofuel.
4. Understand and utilize communications skills to plan for and accomplish objectives/goals.
5. Understand that chemical bonds require energy to form, and release that energy when broken.
6. Evaluate the pros and cons of biodiesel, and develop a persuasive argument for the use of biodiesel as an alternative to fossil fuels.
7. Identify and explore the impacts (intended and unintended) of technological advancements in Agriculture and related biotechnologies, Energy and Power, and Transportation Technologies.
8. Explore the ecological and economic impacts of unethical decisions (case studies and scenarios of regulation violations, whistle-blowing, kick-backs, pay-offs, labor disputes, illegal dumping, straight-pipe sewage, etc.).
9. Design and fabricate evaluation tools (instruments, models, simulations, software) that assess the impact of products and systems through information collection and data synthesis.
10. Explain the properties and atomic structure of radioactive elements.
11. Describe how electricity can be generated from radioactive sources.
12. Demonstrate an understanding of careers in Energy Generations and Transmission/Distribution.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Architectural Design and Civil Engineering

Valid Course Code: 210140

Course Description: This course is for students who wish to broaden their basic skills in the field of residential architectural drafting and surveying. Covers procedures used in developing complete set of residential plans, history of surveying, mathematics, measurement and computations, and the proper use of basic drafting and surveying instruments, equipment and software. Students will develop projects in accordance to drafting and building code requirements. Projects will emphasize the importance of communication and organization as they participate in the roles of civil engineers, architects, land developers, surveyors, and/or general contractors in residential planning and construction. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Prerequisite: 210223 Fundamentals of Architectural and Civil Engineering

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
3. Employ computer operations applications to access, create, manage, integrate, and store information.
4. Prepare architectural drawings, such as floor plans, site plans, elevations, and prepare roof plans.
5. Demonstrate understanding of civil drawings.
6. Develop architectural models.
7. Set up surveying equipment and apply its use to real-world application.
8. Use oral and written communication skills in creating, expressing and interpreting information and ideas.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Engineering and Engineering Technology Co-op
Valid Course Code: 210330

Course Description: Cooperative education is a paid educational program consisting of in-school instruction combined with the program related on-the-job work experience in a business or industrial establishment. These are planned experiences supervised by the school and the employer to ensure that each phase contributes to the students Individual Learning Plan (ILP). Refer to the KDE Work Based Learning Manual for further specifications.
Participation in Kentucky Technology Student Association will greatly enhance instruction.

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s).
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Engineering and Engineering Technology Design (Capstone)
Valid Course Code: 210110

Course Description: Engineering scope, content, and professional practices are presented through practical applications in this capstone course. Students in engineering teams apply technology, Kentucky Academic Standards, and skills to solve engineering design problems and create innovative designs. Students research, develop, test and analyze engineering designs using criteria such as design effectiveness, public safety, human factors and ethics. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Identify, define, and justify a technical design problem for resolution.
3. Conduct research and investigation into the stated problem.
4. Perform and graphically represent an evaluation of proposed design solutions using specific criteria, including product specifications.
5. Design a solution to the problem and create a working prototype for testing.
6. Evaluate and select appropriate testing methodologies for testing the product, conduct product testing, refine the design as needed, and document the process and results.
7. Create and deliver a formal presentation of the solution to the problem to community stakeholders.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Engineering and Engineering Technology Internship
Valid Course Code: 210331

Course Description: Internship for CTE courses provides supervised work-site experience for high school students associated with their identified career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s).
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Foundations of Energy

Valid Course Code: 210341

Course Description: The course provides an overview of renewable and nonrenewable energy resources reflecting how energy impacts the environment and the economy from regional, state, national and global perspectives. Extensive hands-on laboratory activities are vital component in this course. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop competencies and skills in the areas of energy.
3. Engage in meaningful hands-on minds-on conceptual based activities in the areas of energy.
4. Develop competencies in the safe and efficient use of the tools, machines, materials and processes of energy technology.
5. Demonstrate employability and social skills relative to careers in energy industry.
6. Understand electric power generation, transmission and distribution.
7. Use computer-based skills related to concepts of energy in the various technologies.
8. Demonstrate knowledge and skills in blueprint reading in energy technologies.
9. Demonstrate and develop fundamental skills and knowledge of tools in the energy industry.
10. Apply basic electricity concepts and knowledge as it applies to energy technologies.
11. Describe similarities and differences between renewable and nonrenewable sources of energy.
12. Develop core competencies in the area of safety.
13. Identify ways to conserve energy.
14. Compare advantages and disadvantages in the use of the various energy sources.
15. Assess the impact of the various energy sources on the economy in Kentucky.
16. Differentiate between the terms energy and electricity.
17. Describe the difference in potential and kinetic energy.
18. Analyze how supply and demand impacts Kentucky's economy in relation to energy.
19. Investigate the role of technology in the future development of energy usage.
20. Map the major sources of energy used in Kentucky.
21. Analyze the impact energy has on the environment.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Foundations of Engineering Technology

Valid Course Code: 210107

Course Description: This course provides the “foundation” for students to understand and apply technological concepts and processes that are the cornerstone for the high school technology program. Group and individual activities engage students in creating ideas, developing innovations, and engineering practical solutions. The course will employ teaching/learning strategies that enable students to build their understanding of new ideas. It is designed to engage students in exploring and deepening their understanding of “big ideas” regarding technology. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop and demonstrate strategies and work habits that lead to success.
3. Apply technological concepts (such as simple machines, circuits, sketching, fluid systems, etc.) to solve technical problems.
4. Define and describe the nature of technology.
5. Demonstrate an understanding of the dynamic nature of technology, analyze and interpret historical events, conditions, trends and issues to develop perspective on the impacts of technology on people, society, culture, and the environment.
6. Demonstrate an awareness of current and emerging issues (e.g., ethical, social, legal, environmental, political, and privacy) related to technology.
7. Explore technological concepts and processes in the contexts of Energy and Power, Information and Communication, Transportation, Manufacturing, Construction, Medical, Agriculture and Bio-Related Technologies.
8. Identify opportunities, characteristics, and preparation requirements for occupations in current and emerging technology.
9. Demonstrate an understanding of technological systems and the interrelationship between the resource/input, process, output, and feedback elements of these systems.
10. Develop competencies in the safe, efficient, and effective use of tools, machines, materials, and processes.
11. Communicate design solutions through formal and informal presentations.
12. Demonstrate team, social, and employability skills relative to careers.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Foundations of Robotics
Valid Course Code: 210238

Course Description: This course provides students with the foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Demonstrate an understanding of robotics, its history, applications, and evolution.
3. Describe Artificial Intelligence (AI) and the forms of applied logic.
4. Describe the role of sensors in the field of robotics.
5. Demonstrate an understanding of the foundations of electronics.
6. Describe the operation of basic electronic devices used in robotics.
7. Demonstrate an understanding of engineering principles.
8. Explain fundamental physics concepts applicable to the field of robotics.
9. Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.
10. Build, program, and configure a robot to perform predefined tasks.
11. Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Fundamentals of Architectural and Civil Engineering

Valid Course Code: 210223

Course Description: This is an introduction to residential and light commercial building construction and design. Students will learn basic sketching, architectural drafting skills with an emphasis on computer aided drafting. In this class, students will design a structure relevant to today's modern architecture and create models of their designs with various materials and tools. Students will experience and solve many problems in designing or building structures with regards to environment and community impact and limitations from town planning, urban design and landscape architecture to furniture and objects. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Perform basic computer aided drafting functions and develop knowledge and skills in the use of various software programs.
3. Create project planning documentation including site information and development options.
4. Conduct site planning including grading, public ingress/egress, utilities, landscaping, water supply, and wastewater management.
5. Develop architecture plans reflecting various architectural styles that include floor plans, elevations, sections and details, schedules, HVAC, plumbing, and electrical systems, as well as communication and protection systems.
6. Define and evaluate structural engineering components including foundations, columns, beams, and roof systems.
7. Develop presentations of potential construction projects.
8. Use principles and elements of design including portfolio development containing various written work, drawings, models, and other documentation.
9. Perform sketching and visualization using proper techniques and tools to produce pictorial, annotated sketches, multi-view or orthographic drawings using proper and accurate measurements.
10. Perform modeling using conceptual, graphical, physical, mathematical, and computer generated techniques, including 3-dimensional software.
11. Conduct model analysis and verification.
12. Create model documentation including working drawings, dimensioning, and annotations.
13. Develop product presentations using proper communication techniques and appropriate presentation aids.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Fundamentals of Building Construction Technologies

Valid Course Code: 210141

Course Description: Students explore architectural design foundations and increase understanding of working drawings, construction techniques, and codes regulating building design. They learn the design process and apply the elements and principles of design to architectural projects. Through producing models and illustrations of all aspects of a building, students create architectural design solutions using CAD (computer aided design). Students design and build scale or full-size structures and work with projects that help them understand the jobs of architects, carpenters, electricians, plumbers, surveyors, contractors, masons, design engineers, and a variety of other construction careers. They also explore aspects of the construction industry. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Prerequisites: 210223 Fundamentals of Architectural and Civil Engineering and 210140 Architectural Design and Civil Engineering

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Use basic drafting tools and techniques and develop accurate measurement techniques to communicate drafting ideas.
3. Demonstrate various drawing scales used in technical drawing.
4. Through the use of basic drafting equipment students will produce geometric shapes and figures that describe various objects, structures, and designs.
5. Demonstrate knowledge and skill with illustration technique and working drawings.
6. Demonstrate basic mathematic concepts in basic arithmetic, algebra, geometry, and trigonometric to solve problems and apply multiple discipline calculations.
7. Describe basic house design concepts.
8. Summarize modern innovations and techniques used in new construction.
9. Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
10. Describe the development of construction technology, its impact on the built environment and the impact of growth on the construction industry.
11. Define the roles and responsibilities of the general contractor, specialty contractor, construction management and design build firms.
12. Describe the process of applying for building permits and variances.
13. Select and safely use hand and power tools and describe their operations.
14. Demonstrate carpentry skills through construction of various forms, layout and framing of floors, walls, and building structures and components.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Global Energy Issues

Valid Course Code: 210244

Course Description: The course critically examines issues associated with the technical, economic, societal, environmental, and geopolitical aspects of energy and sustainability. Students will develop competencies in the area of energy history and the global impact of renewable and non-renewable resources; career opportunities; environmental principles. The course is taught through lectures, discussions, hands on activities, field trips and invited speakers. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Describe basic concepts of energy and power, including types of energy, conversion of energy, and conservation of energy and energy analysis.
3. Understand and apply sustainability in various aspects of the world around them including the campus, local, national and global initiatives.
4. Explore, review and discuss the current mix of energy sources in use around the world, including coal, natural gas, oil, nuclear, solar, wind, geothermal, hydro, and biomass. Articulate the basics of each technology, the pros and cons of each resource, and the major challenges facing each resource.
5. Prepare a presentation of the basics of electric power, including emerging issues of smart grid transmission and distribution.
6. Understand and discuss the basic environmental issues with energy generation and use, the basic policy issues of power and energy, including environmental regulation, pricing, and development.
7. Explain the basic economic aspects of power and energy, including energy markets.
8. Describe the relationships between energy use and economic activities, standard of living, and cultures.
9. Investigate and interpret the basic geopolitical issues of power, including national security and economic security. By using critical and creative inquiry, students will demonstrate a grasp of the global inequalities and diversities that exist with respect to energy across the world.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Graphic Communications

Valid Course Code: 210133

Course Description: This is a fundamental course that offers a cross-disciplinary program designed for students interested in gaining knowledge and skills in various phases of graphic communication technology. This is a project based program with activities in, but not limited to, computer design, digital imaging, document layout, multimedia, web site development, digital printing, offset printing, screen and sublimation printing processes, bindery, packaging technology. Students apply creative problem solving while learning about technology and management practices related to the production and distribution of graphic media in its many forms. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Apply communication skills through presentations, reports, and demonstrations.
3. Understand the evolution and purpose of graphic design.
4. Explore various methods of printing, audio and video, digital imaging, and computer aided design for the production of graphic communication projects.
5. Develop and demonstrate strategies and work habits that will lead to success and prepare the student for future careers in a technological world.
6. Demonstrate an understanding of and be able to select and use information related to communication technologies.
7. Identify current and emerging careers related to communication technology.
8. Develop proficiencies in the safe, efficient, and effective use of tools, machines, materials, and processes.
9. Perform layout, design, and measurement activities associated with desktop publishing.
10. Demonstrate technical knowledge and skills in the area of product design and design process.
11. Develop an awareness of emerging technologies associated with communication design.
12. Communicate the culminating experience/project through reflection, documentation, and various presentation techniques.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Introduction to Alternative Energy

Valid Course Code: 210242

Course Description: This course provides students with the foundation in content and skills associated with various energy sources, and electrical power generation, transmission, and distribution. Students will develop competencies in the area of energy history and the global impact of renewable and non-renewable resources; career opportunities; environmental principles, working with AC/DC electrical circuits, and transfer of various energy forms to produce DC current. Laboratory-based activities are an integral part of the course that includes safe use and application of appropriate technology, scientific testing and observation equipment. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Summarize the value of alternative energy.
3. Describe the importance of professional ethics and legal responsibilities with regards to alternative energy opportunities.
4. Explain the significance of various alternative sources of energy.
5. Demonstrate personal money-management concepts, procedures, and strategies for alternative energy use.
6. Identify the pioneers in the field of developing energy alternatives.
7. Identify how the characteristics of goal-directed research impact technology.
8. Describe factors that motivate technological development (e.g. profit, function, form, quality, etc.).
9. Differentiate between petroleum diesel and biodiesel and between the operation of a gasoline engine and a diesel engine.
10. Trace the flow of energy through an ecosystem.
11. Know the basic structure and characteristics of atoms, including how they bond.
12. Analyze current and emerging issues (e.g., ethical, social, legal, environmental, political, and privacy) related to technology to identify appropriate and inappropriate applications of technology.
13. Describe how electricity can be generated from radioactive sources.
14. Design, construct, and assess alternative solutions to technological problems that minimize/alleviate negative impacts.
15. Understand and utilize communications skills to plan for and accomplish objectives/goals.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Introduction to Manufacturing and Manufacturing Systems

Valid Course Code: 210225

Course Description: This is a comprehensive course designed for the study of general concepts and principles of manufacturing and manufacturing systems. This course provides for hands-on learning experience which enhances the understanding of various metallic/nonmetallic materials, processes, and products. Materials studied may include polymers, ceramics, woods, composites, and metal materials associated with manufacturing. Students have the opportunity to engage in product design, prototyping, computer-assisted manufacturing applications, CNC machines, robotics, and production management.

Participation in Kentucky Technology Student Association will greatly enhance instruction.

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Identify the basic processes, systems, designs, and materials used in manufacturing.
3. Identify product families.
4. Conduct model documentation as the process of recording details such as size, material composition, and instructions for assembling, installation and servicing, analysis, development process that describes a model for the purpose of communication of ideas.
5. Apply the principles of design for manufacturing enabling the efficient and effective production of products.
6. Distinguish the difference between custom and industrial furniture production.
7. Demonstrate safe and appropriate use of tools, machines, and materials in materials and processes technology.
8. Select and defend a material for use in a product, explaining material properties and characterization, based upon manufacturing processes, chemical composition, internal defects, temperature, previous loading, dimensions and other factors.
9. Demonstrate an understanding of mechanisms and how they relate to manufacturing systems.
10. Apply the principles of robotics to automated systems.
11. Integrate control systems and equipment with production and production support mechanisms.
12. Demonstrate proficiency in the set-up and operation of manual and CNC wood and/or metalworking machines.
13. Demonstrate proficiency in computer-aided drafting/computer aided manufacturing (CAD/CAM) software.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Mechanical and Technical Design

Valid Course Code: 210138

Course Description: This is considered a basic course that will provide students with instructions in the characteristics and evolution of drafting technology, underlying principles of design and fundamental knowledge and skills in the use mechanical drawing, illustrations, and various forms of mechanical drawings, geometry and applied mathematics that apply to architectural and/or engineering design. Introduction to various forms of computer aided software to gain basic skills and knowledge. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Define and demonstrate appropriate technical drawings based on design solution.
3. Use basic drafting tools and techniques and develop accurate measurement techniques to communicate drafting ideas.
4. Demonstrate various drawing scales used in technical drawing.
5. Through the use of basic drafting equipment students will produce geometric shapes and figures that describe various objects, structures, and designs.
6. Demonstrate knowledge and skill with illustration technique and working drawings.
7. Demonstrate basic mathematic concepts in basic arithmetic, algebra, geometry, and trigonometric to solve problems and apply multiple discipline calculations.
8. Prepare mechanical drawings that consist of, but not limited to, isometric, oblique, 3-view orthographic projections, auxiliary views, sectional and dimensions.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Power and Energy Equipment Technology

Valid Course Code: 210142

Course Description: Power and Energy Equipment is used every day in many different ways. To become a more environmentally friendly society, students will have a basic understanding of the various types of energy equipment and how energy is obtained or generated. Everyone should know what energy sources are available that do not pollute the environment and how this energy can be converted into a useful power supply. This course provides students with the foundation in content and skills associated with various energy sources, and electrical power generation, working with AC/DC electrical circuits, and transfer of various energy forms to produce DC current. Laboratory-based activities are an integral part of the course that includes safe use and application of appropriate technology, scientific testing and observation equipment. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Describe sources of energy.
3. Demonstrate an understanding of the cultural, social, economic, and political effects of power and energy technology.
4. Demonstrate an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
5. Demonstrate the abilities to use and maintain technological products and systems.
6. Demonstrate an understanding of and be able to select and use energy and power technologies.
7. Demonstrate safe and appropriate use of tools, machines, and materials in power and energy technology.
8. Demonstrate technical knowledge and skills related to power and energy systems.
9. Demonstrate technical knowledge and skills about steam power technology.
10. Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology.
11. Demonstrate technical knowledge and skills about electric power technology.
12. Demonstrate technical knowledge and skills about solar cells and fuel cells.
13. Measure and report the power and efficiency of power producing systems.
14. Conduct a research and experimentation project on an energy and power system.
15. Demonstrate an understanding of career opportunities and requirements in the field of power and energy technology.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Production Technology

Valid Course Code: 210135

Course Description: This course allows students the opportunity to develop a project from "vision to reality by working with teams to design, engineer, manufacture, construct, test, redesign, and produce a finished project. This course can serve as capstone course working with business and industry as part of their design, development, fabrication, and marketing using skills and knowledge from previous manufacturing courses. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Develop and demonstrate strategies and work habits that will lead to success and prepare the student for future careers in a technological world.
3. Employ the manufacturing process including the designing, development, fabrication, troubleshooting and testing, problem solving and marketing various products.
4. Research and identify consumer demands for a manufacture product.
5. Prepare a plan for marketing and distributing a manufactured product.
6. Identify current and emerging careers related to technology.
7. Demonstrate safe and appropriate use of tools, machines, and materials.
8. Identify statics and strength of materials as it relates to their specific project(s).
9. Identify material classifications and properties utilizing appropriate testing methods as it relates to their specific project(s).
10. Use appropriate engineering methodology for maximizing product reliability.
11. Demonstrate technical knowledge and skills associated with processing activities and practices of industrial materials.
12. Evaluate various types of wood, wood composites and industry related materials as it relates to their specific project(s).

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Principles of Engineering Technology

Valid Course Code: 210224

Course Description: This course provides a project based learning approach to understanding the principles and concepts of physics and associated mathematics for most Engineering Technology programs. Students explore various careers and disciplines of engineering areas, problem solving and core technology such as, but not limited to; manufacturing, power/energy/transportation, robotics, hydraulics, electricity/electronics, communications, construction systems, alternative energy and computer aided design.

Participation in Kentucky Technology Student Association will greatly enhance instruction.

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Define the various types of engineering.
3. Apply communication and documentation including sketching, technical writing, data representation and presentation.
4. Define engineering systems including mechanisms, thermodynamics, fluid systems, electrical systems and control systems.
5. Identify statics and strength of materials.
6. Identify material classifications and properties utilizing appropriate testing methods.
7. Consider the ethical, environmental, social, and economic impact of the engineering design process is essential to being a responsible, involved citizen.
8. Calculate work and power in mechanical systems.
9. Measure forces and distances related to simple machines and mechanisms.
10. Calculate mechanical advantage and drive ratios of mechanisms.
11. Design, create, analysis and produce a mechanical system.
12. Define dynamics/kinematics including linear and trajectory motion.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Robotics Applications Capstone
Valid Course Code: 210240

Course Description: This course provides students with skills essential to the design and operation of autonomous robotic systems in the context of a capstone project. Students will design and build an autonomous robot to perform pre-designed tasks. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

***Prerequisites: 210238 Foundations of Robotics and
210239 Robotics Design Essentials and Systems***

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Demonstrate an understanding of robotic applications (both stationary and mobile), their environments, and their unique design constraints.
3. Design, build, program, and configure an autonomous robot to perform predefined tasks suitable for a particular robotic application.
4. Plan, organize, and carry out a project plan which incorporates robotics and Flexible Manufacturing Systems (FMS).
5. Demonstrate safe and appropriate use of tools, machines, and materials in materials and processes technology.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Robotics Design Essentials and Systems

Valid Course Code: 210239

Course Description: This course provides students with content and skills essential to the design and operation of robotic systems. Students activities will include artificial intelligence specialized sensors, electronic applications, engineering technologies, environmental physics, manufacturing, topographical considerations, programming, motions physics, electric motors, communications, simulations, simulation and modeling, and critical thinking skills.

Participation in Kentucky Technology Student Association will greatly enhance instruction.

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Correlate elements of artificial intelligence to their functions in robotics.
3. Describe the various classification schemes of sensors applicable to robotics.
4. Explain how electronic devices are used in the operation of a robotic assembly.
5. Demonstrate an understanding of various technologies used in the design of robotic assemblies.
6. Demonstrate an understanding of advanced mathematics and physics associated with the design of a robotic assembly.
7. Create a program to control a robotic mechanism.
8. Describe the operation and use of various forms of electrical motors in robotic assemblies.
9. Demonstrate an understanding of basic 3D modeling concepts as it relates to robotics.
10. Analyze and apply data and measurements to solve problems and interpret documents.
11. Design, build, program, and configure a robot to perform predefined tasks.
12. Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
13. Describe the approaches, challenges, and problem-solving methodologies involved with integrating artificial intelligence into robotic systems.
14. Describe the role of specialized sensors in the design and operation of robotic systems.
15. Describe the use of specialized electronic applications used in robotic systems.
16. Demonstrate an understanding of the impact of robotics on the manufacturing process.
17. Create a program to control a robotic system.
18. Demonstrate an understanding of technologies for communication with and among robotic systems.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards

Technological Design
Valid Course Code: 210108

Course Description: This course contributes to the development of each high school student's capability to understand how technology's development, control, and use are based on design constraints and human wants and needs. The structure of the course challenges students to use technological design processes so that they can think, plan, design, and create solutions to engineering and technological problems. Students are actively involved in the organized and integrated application of technological resources, engineering concepts, and scientific procedures. Students address the complexities of technology that stem from designing, developing, using, and assessing technological systems. **Participation in Kentucky Technology Student Association will greatly enhance instruction.**

Content/Process

Students will:

1. Apply the design process involving problem identification, conceptualization, and research, refinement of preliminary ideas, design analysis, development and implementation, detailed documentation of final design, optimization and final presentation.
2. Use the design process to fabricate products related to one or more of the seven contexts of technological literacy (agriculture, bio-related, medical, construction, manufacturing, transportation, and communications).
3. Engage in meaningful, hands-on, minds-on, technology-based activities using tools, machines, materials, and processes.
4. Analyze various design concepts, constraints, and processes related to product development employing critical thinking skills.
5. Work individually, in teams, or as a total class to solve design-related activities.
6. Identify opportunities, characteristics, and preparation requirements for current and emerging design related occupations.

Connections

- Kentucky Technology Student Association (KYTSA)
- Kentucky Occupational Skill Standards (KOSSA) **OR**
Appropriate Industry Certification
- Standards for Technological Literacy
- Kentucky Academic Standards